KOPIO TN109

Estimate of loss due to stopped muons

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Abstract

Using results from TN099 I estimate that the accidental veto rate due to stopped muons will be 1.38% and 0.24% per nanosecond of the veto gate for the photon veto and charged particle veto detectors, respectively.

Muons that stop and decay in the active area of the KOPIO detector can cause two problems: accidental vetos and fake photon background. This note estimates the rates of accidental vetos from stopped muons.

Marvin Blecher used the KOPIO GEANT Monte Carlo to calculate the rate of stopped muons in the KOPIO detectors in TN099 [1]. In TN099 only muons that had decay products in a sensitive detector element were counted in the rate of stopped muons. The stopped muon rates are listed in Table 1 for each detector element.

Figure 1 shows the accidental loss as a function of the width of the veto under the assumption that the entire stopped muon rate is detectable. This is a reasonable, slightly conservative, assumption given that Marvin found that 87% of the stopped muon rate was detectable for the thresholds used in TN099 [1].

FastMC studies [2] indicate that a CV width of 12 ns would give acceptable rates. A minimum PV width is probably 5 ns. From Figure 1, this would give a loss of $\sim 10\%$ due to stopped muons. As pointed out by Andries van der Schaaf, we need to use our PV elements to efficiently detect products of charged particles that interact before detection in CV elements. If this requires a PV width comparable to the CV width, then the loss would be $\sim 20\%$.

Acknowledgements

I thank Marvin Blecher for comments on a draft of this note and for producing TN099.

References

[1] M. Blecher, *Stopped Muon Rates in KOPIO Detectors*, KOPIO TN099, 14 July 2004.

[2] D.E.Jaffe, *CPV studies (24Aug04)*, `http://www.phy.bnl.gov/d̃jaffe/KOPIO/TaskForce/status24aug04.pdf`.

Photon veto	Rate (MHz)	Charge veto	Rate (MHz)
CAL	2.4	US pipe	0.33
PR	3.8	US trap.	0.058
OV	0.23	BV	0.62
BV	1.806	DS trap.	0.130
UV	0.895	DS pipe	0.70
DSPV1	2.63	DSCV1	0.54
DSPV2	0.2	DSCV2	0.007
DSPV3	1.75	DSCV3	0.053
BCAT	0.12		
TOTAL	13.831	TOTAL	2.438

Table 1: Stopped muon rates from TN099 [1]. DSPV1 is the PV inside the D4 magnet, DSPV2 are the PV elements downstream of D4 on either side of the beam, DSPV3 are the PV elements downstream of D4 above and below the beam. "trap." means trapezoidal CV elements that form the transition from the BV to the pipes.

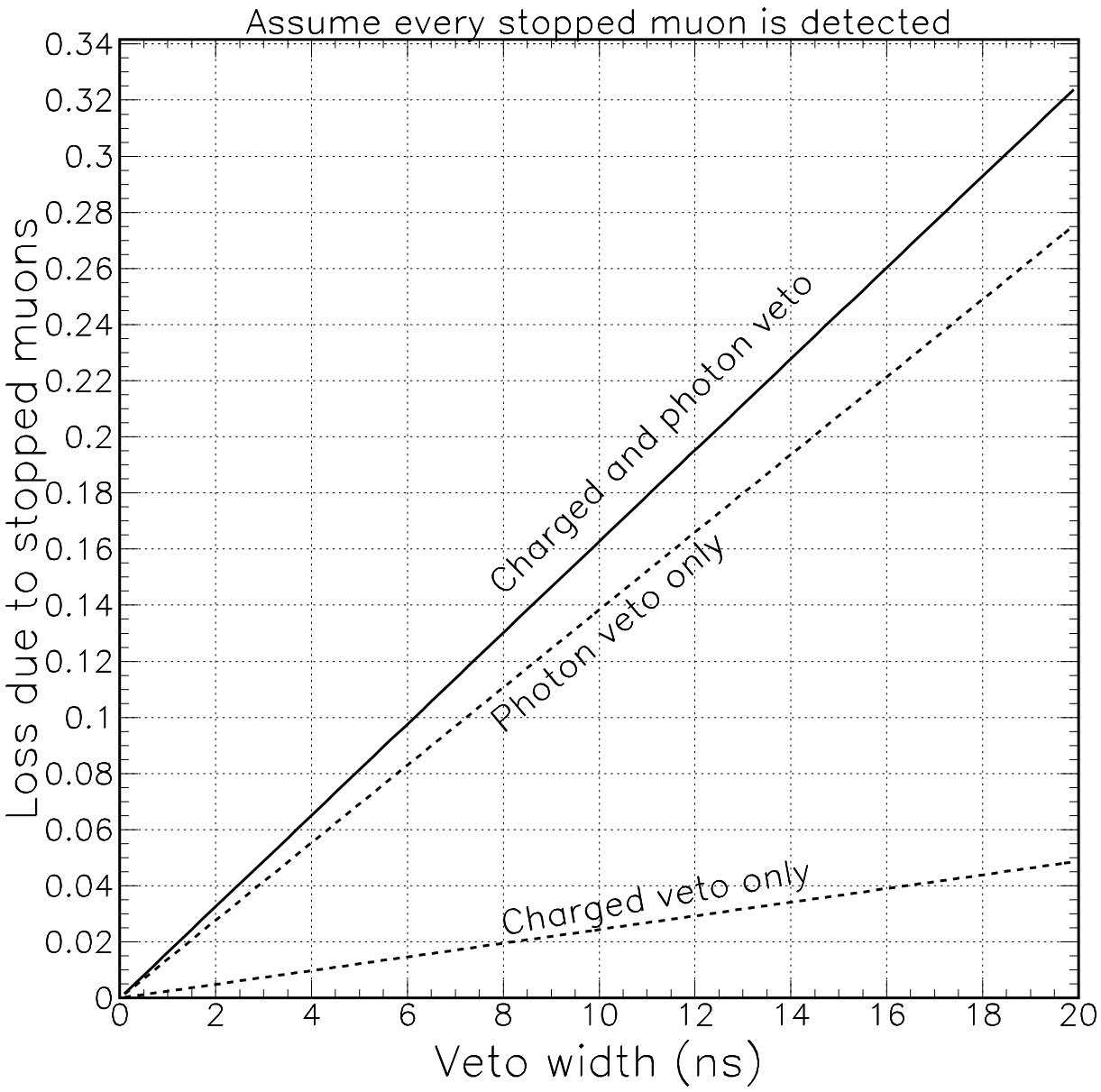

Figure 1: The estimated loss due to stopped muons. The solid line assumes a common veto width for all veto elements. The dashed lines show the loss for veto gates on the photon veto or charged veto elements only.